

University of Cambridge
School of Agriculture Memoirs

Memoir No. 23

A summary of the papers published by the members of the Staff of the School of Agriculture and its Associated Research Organisations during the period Oct. 1st, 1950—Sept. 30th, 1951.

Review Series

No. 6. Agricultural Economics at
Cambridge, 1896—1951.



CAMBRIDGE
1952

FOREWORD

This Memoir, which is published under the general editorship of the Librarian of the School, represents an attempt to present as succinctly as possible the contributions made by members of the Staffs of the School of Agriculture and its Associated Research Organisations to the development and progress of Agricultural Science, to indicate to research workers interested the Journals in which the full papers are presented and to act as a complete record of papers published. Each summary is compiled by the author of the paper and is presented, so far as the subject matter will allow, in a non-technical form in order to be of value to the general body of farmers interested in the more recent developments of agricultural scientific research in general and of the activities of this Department in particular.

Requests for further information or criticism arising out of the summaries should be referred to the individual author concerned, criticisms and suggestions for the improvement of the Memoir itself should be addressed to the Librarian of the School.

The Librarian takes this opportunity of thanking all Institutions etc. who have kindly sent literature during the past year.

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AGRICULTURAL ECONOMICS AT CAMBRIDGE, 1896—1951*

By

A. W. MENZIES-KITCHIN, Ph.D.

(Provincial Agricultural Economist)

During the latter stages of the preparation of this article the author, Dr A. W. Menzies-Kitchin, fell ill, and finding himself unable to deal with the final proofs within the time allotted, agreed to depute the task to his colleagues Messrs D. B. Wallace and R. A. Mackness, who have added the finishing details and read the final proofs.

The illness proved more serious than had been expected and Dr Menzies-Kitchin, at the comparatively early age of 47, to our great sorrow died on 31 December, 1951, and was laid to rest in Swaffham Prior Churchyard on Friday, 4 January, 1952.

Dr Menzies-Kitchin played an important part in the development of the subject of Agricultural Economics at Cambridge and in this country, a service that the University recognised by appointing him Reader in October, 1950.

In 1896, seven years after the formal recognition of teaching in Agriculture in the University, the late Sir Walter Gilbey, who was then President of the Royal Agricultural Society of England, wrote to the Vice-Chancellor "that he was much impressed with the little knowledge which appeared to exist as to the methods of the past and the ways in which our ancestors met problems and difficulties which they, like us, had to face" and offered to endow a lectureship in the History and Economics of Agriculture "for a period sufficiently lengthy to enable a matured judgment to be formed of the practical utility of such lectures to students of the University". This was the first benefaction for agriculture and the beginning of teaching in agricultural economics. At the outset the course consisted of twelve lectures, open to all members of the University, delivered by a non-resident lecturer specially appointed for the purpose. In the first instance they were given by Sir Ernest Clarke who for thirty years had been secretary of the Royal Agricultural Society of England and who treated his audience to a learned disquisition, with copious references from the classics, on early agricultural writers and systems. Sir Ernest Clarke's course extended over two years and he was followed for similar periods by Mr H. H. Smith, Professor Shield Nicholson and Major P. G. Craigie, C.B. Major Craigie's term of office ended in 1909 and it was at his suggestion that in 1910 a resident lecturer was appointed to give a continuous course throughout the year. The first resident lecturer was Mr F. R. Salter of Trinity and Magdalen who agreed to provide a course of lectures in the History and Economics of Land Tenure. Mr Salter was succeeded in 1910 by Mr C. R. Fay of King's College who later became University Reader in Economic History. Apart from War Service Mr Fay held the post until 1921 when he was followed by Dr J. A. Venn of Trinity (later President of Queens') who during the 1914-18 war had been engaged in the statistical branch of the Ministry of Agriculture. In 1922, during Dr Venn's tenure, the Farm Economics Branch was formed under his direction.

Before this, although certain private individuals had kept details of agricultural production costs on their own farms, very little was known about the cost structure of the agricultural industry. During the 1914-18 war the lack of such data was felt acutely, with the result that after the war the Ministry of Food and Agriculture administered jointly an undertaking designed to collect reliable statistics for judging the economic condition of the industry. This organisation, however, had to be abandoned after a year as a result of the post-war demand to reduce national expenditure. Nevertheless the need for such data was urgent and the matter was raised again in the winter of 1922 when, on the repeal of the Agriculture Act, 1921, the Government decided to set aside the sum of £1,000,000 for agricultural education and research. It was then decided that part of this money should be used to establish State aided costings and for this purpose grants were made by the Ministry of Agriculture to five centres—Cambridge, Oxford, Reading, Leeds and Wye, and work was begun.

At the outset the objectives of the scheme were: (1) to collect information on the economic structure of the farming industry; (2) to demonstrate to the farmer the advantage of keeping accounts; and (3) to assist the less progressive farmers to improve their efficiency. The Cambridge Province, which formed the territory of the Farm Economics Branch, embraced the counties of Norfolk, Suffolk, Essex, Hertford, Bedford, Cambridge, the Isle of Ely, the Soke of Peterborough, and the Holland and Kesteven divisions of Lincoln. (Kesteven was transferred later to Nottingham.)

The first problem was to collect staff and at this point Dr Venn was joined by three of his former pupils—Mr R. McG. Carslaw, who was later head of the Branch from 1932 to 1938, as chief assistant, Mr J. R. V. Smythe, and Mr G. L. Rogers who was to act as field officer. (As Gilbey Lecturer Dr Venn continued after 1932 to give the course of lectures on history and economics of agriculture until his retirement in 1949 when he was succeeded by Miss E. H. Whetham of Newnham.) With this staff it was decided to begin by collecting full cost accounts on as many farms as possible. During the next year, therefore, full costs were collected on 25 farms selected over a wide area and representing a number of different farming types. There were, for example, 2 dairy farms, 3 mixed arable farms, 2 fruit farms, 1 arable sheep farm, and so on.

* This is the sixth of a series of articles summarizing phases of agricultural research particularly associated with the School of Agriculture since its inception. Further contributions on other work will appear in future issues.

In 1922 the technique of full costs in agriculture had not been developed and agreement on disputed questions of accounting was one of the first problems which faced co-operating economists. Cost accounts are of necessity comparative and not absolute and as a result uniformity in accounting principles must be observed from year to year. During the early days, therefore, much time and energy was expended in threshing out problems of technique with economists at other centres. Agreement was, however, finally reached and one of the first publications of the new profession was a short pamphlet entitled "Agricultural Cost Accounts and Agreed Accounting Principles".

From 1922 to 1927 the staff of the Farm Economics Branch was mainly engaged on full costs. During this period a number of reports were published. The first report of the Branch entitled "An Economic and Financial Analysis of Fourteen East Anglian Farms in 1923-4" aroused wide interest. This was followed by a series of similar reports for other years and by more specific studies of particular enterprises. Thus Report No. 5 was an account of the economy of a successful Norfolk poultry farm from 1922-26. Report No. 7 analysed in detail the economy of a Norfolk fruit farm between 1923-26. These were succeeded by highly detailed studies of the sugar beet industry in the Eastern Counties which at this period was in the early stages of its development.

By the end of the 1920's, however, certain doubts were beginning to be felt at Cambridge on the utility of full costs as a method of research. With the staff available, data could only be obtained from a very limited number of farms. Moreover the sample had to be confined to those farmers who were prepared to undertake the very great amount of detailed accounting which the method demanded. At this time farmers still had the option of paying income tax under Schedule B which up to its final removal in April 1949 depended on a multiple of their Schedule A assessment. In consequence only about 17% of all farmers in the Eastern Counties kept accounts and less than 10% on farms below 100 acres and only 15% on farms from 100-150 acres. Any sample of full cost farms, therefore, was likely to be both too small and too biased to give a true picture of the area.

In the late 1920's, therefore, Dr Carslaw went to the United States to study research techniques and particularly the survey method of collecting economic data which was then in use at several American Universities. On his return, his report on "Farm Management Research Technique" provided the basis for the survey method of collecting data which was to be introduced at Cambridge. In the survey technique a recorder visits the farmer with a carefully prepared form arranged to promote logical thought sequence, and by question and answer and reference to records, bills or accounts if available, obtains a statement of prices, costs and quantities from which he can build up a physical and a profit and loss account of the farm. Compared with full costs this method has several advantages. (1) It is much cheaper to operate; (2) it enables records to be obtained from farmers who do not keep accounts and thereby increases the representativeness of the sample; (3) as a result it enables a given staff to handle a much greater number of records, and (4) it can be used to provide a representative "picture" of a particular area.

In order to test the validity of the method, therefore, a pilot survey was carried out in Hertfordshire in 1931. It proved successful and in the following three years the survey method was used throughout the Eastern Counties to collect information from over 1,000 farms in each year, a grant for the purpose being obtained from the Ministry of Agriculture and Fisheries who were particularly interested in the effects of the fall in world cereal prices on the agricultural economy of the Eastern Counties. For the purpose of the enquiry the Eastern Counties were divided into 10 types of farming areas on the basis of soil and proximity to market, viz., the Black Fens of the Isle of Ely, the Lincolnshire Silts, the South Cambs Chalks and so on, and records were obtained from roughly 100 farms in each group. Considerable thought was given to the method of sampling. Eventually it was decided to visit every farm over 20 acres in selected parishes but to omit certain types of specialist farm. Just over 52% of farmers visited co-operated and were suitable. The data collected in the survey (1) gave a general picture of farm practices and incomes in the area; (2) enabled comparison to be made of practice and profits by size of farm; (3) provided standards of comparison for farmers in each particular district. As a result of this survey, three reports entitled "An Economic Survey of Agriculture in the Eastern Counties of England" were published. Besides providing a mass of financial and economic data on farming in the Eastern Counties, these reports presented case studies of profitable and unprofitable farms and analysed the reasons underlying success and failure. They also considered such miscellaneous subjects as the birthplace and age of occupiers, and number of years' experience as a farmer.

In the early 1930's agriculture in the Eastern Counties, predominantly an arable area, was very depressed. Cereal prices generally were low and farmers were turning to livestock production in an attempt to increase their incomes. There was little basic knowledge of methods or costs of producing milk or pigs. In order to provide such data two schemes were started in the early 'thirties—one for milk production and one for pigs. Both provided data capable of being used in the formulation of national or individual farm policy. In the case of the Milk Scheme a report was published in 1940 on "An Economic Study of Foods and Grazing in Milk Production" and again a "Study of Milk Production in the Eastern Counties" in 1950. In these studies, in addition to the straightforward financial data it was possible to examine the effect of seasonality of calving on yields and profit, to assess the changes which had occurred throughout the period in the use of bulky and concentrated feeds in milk production, to compare relative costs of producing summer and winter milk, and to assess the relative advantages of using home grown with purchased feeds. At the same time the study provided standards of achievement for the general body of farmers. Information of a similar character was collected for pigs, from which it was possible to make a close analysis of the physical and economic factors affecting the profitability of pig production and to lay down standards of performance for pig producers. Data were also obtained on such problems as the effect of season on litter size, on indoor *versus* outdoor farrowing and on housing as a factor in weaner production. The results were embodied in "An Economic Study of Pig Production 1936-37".

In addition to reports on various aspects of farm management, reports on more general problems were published in the later 1920's and early 1930's: "The Seasonal Distribution of Farm Labour Requirements in 1930" by W. H. Kirkpatrick; "Factors Affecting the Price of Potatoes in Great Britain" by R. L. Cohen, and later "A Survey of Milk Marketing Schemes and Price Policies" by the same author. Of these the second provided a detailed statistical study which attempted to explain the course of potato prices in England between 1885 and 1930 while the third attempted to evaluate, from the point of view of the community as a whole, the price policies adopted by organised farmers selling milk in America and England.

During the early 1930's a high level of industrial unemployment led to a revival of interest in land settlement and A. W. Menzies-Kitchin, who had been in the Branch since 1931, was seconded to the Carnegie Trust for a year to investigate the possibilities of further settlement. The resulting report "Land Settlement" was published by the Trustees in 1935. During this period miscellaneous publications by members of the Branch included: "The Pattern of Estate Ownership in Cambridgeshire" by J. J. Macgregor, "Labour, Power and Equipment on Arable Farms" by R. M. Carslaw and C. Culpin published in the Journal of the Royal Agricultural Society, "The Changing Organisation of Arable Farms" by R. M. Carslaw and P. E. Graves in the Economic Journal; "Some Aspects of Smallholdings in the Agricultural Structure" by A. W. Menzies-Kitchin, Economic Journal; "Farming Organisation in the Black Fens of the Isle of Ely and in the Lincolnshire Silts", two papers by R. M. Carslaw and P. E. Graves; "Wastage, Length of Productive Life and Replacement and Depreciation of Dairy Cows" by G. H. N. Pettit in the Journal of Agricultural Science; "Labour Bill and Output of Arable Farms" by R. M. Carslaw and P. E. Graves (Journal of the Royal Statistical Society); "Fertility, Mortality and Growth Rate of Pigs" by A. W. Menzies-Kitchin (Journal of Agricultural Science).

During the 1930's, therefore, the interests of the Branch were widening. The staff was still small but was unburdened by the routine collection of data which was to come with the war, and individual interests were being developed. Dr A. W. Menzies-Kitchin succeeded Dr Carslaw as Provincial Economist in 1938.

On the outbreak of war in 1939 emphasis was changed and the work of the Branch became more and more identified with the war effort, mainly in connection with agricultural price and production policy. At the Government's request, the Farm Management Survey which from 1935 until 1939 had been confined to four "type of farming" areas, was gradually increased to cover ten areas providing 500 records a year. From these, an identical sample of 400 records was used every year to compare changes in input and output and in profits resulting from alterations in production policy and prices. Moreover with the introduction of guaranteed prices for agriculture, it became necessary to undertake for the guidance of the Government, regular production and cost studies of the main cereal, root and vegetable crops as well as studies of flax production, a crop which, as in 1914-18, had to be introduced on British farms after Belgium was overrun. At the same time the studies of milk and pigs which had been in operation before the war, continued until the reduction in pig numbers as a result of the shortage of imported feeding stuffs brought the pig scheme to an end. The Food Recording Scheme for Dairy Cows, however, was expanded and the data obtained became one of the principal adjuncts in the deliberations on milk prices.

During this period, however, the most massive task undertaken by the Branch was handling, checking and drawing the sample from the records of the National Farm Survey sometimes called the Doomsday Survey. This survey depended on three sets of data: (1) the June 4th returns for 1941 collected postally by the Ministry of Agriculture; (2) a special survey of the condition of the farms in 1941 collected by visit by officers of the War Agricultural Executive Committee in every County and (3) a complete cover of all farms in the area delineated on ordnance survey maps. All three groups of data had to be checked and a stratified sample drawn for tabulation by the Hollerith machine. For the Eastern Province this meant handling and checking the records of between 40-50,000 farms.

Although the report on the National Farm Survey was prepared by the Ministry of Agriculture, the data collected remained available for research purposes. It was hoped from this material to prepare after the war a series of monographs on certain aspects of agriculture in the Eastern Province. The project was delayed by post-war staffing difficulties. From the material collected, however, P. E. Graves and L. Uribe carried out, between 1945 and 1947, a detailed study of Land Ownership in the Eastern Counties in 1941. This study included 35,159 agricultural holdings covering 3,819 million acres of land. Several interesting facts emerged from it about the pattern and influence of ownership. There were, for example, almost as many landowners in the area as there were farmers, while of the total area 42.6% was owner occupied. On the other hand there were only 234 estates of over 2,000 acres. Of these only 175 were in the hands of private individuals. Of the remainder 21 were held by companies and 38 were owned by the Church, Colleges or public authorities. It also emerged that condition of fixed equipment varied considerably between types of ownership and size of holding.

After the war it quickly became evident that the world food situation was unlikely to return to its pre-war pattern and that to stimulate home production the U.K. Government would have to continue its policy of guaranteed prices to farmers. As there had been some dissatisfaction with the methods of price fixing the Government, in the Agricultural Act 1947, laid down the procedure, now known as the February Price Review, which had been originally announced by the Minister in the House of Commons in December 1944. Such costs and other data as the Ministry of Agriculture and Fisheries required were to be collected by the Provincial Agricultural Economists. It was agreed between the Ministry and the Universities in which the Economists were centred, that in return a sum equal to that spent on this "requested" work should be provided by the Ministry for "free" research in agricultural economics at these Universities.

During the war the work of the Farm Economics Branch expanded rapidly; much of it was of a routine character and was done by graduate staff who did not intend to adopt agricultural economics as a career. As a result, an exodus occurred at the end of the war and the staff which remained was little more than sufficient to carry out the very substantial volume of requested work. The first five years of peace, therefore, was a

period of recuperation rather than growth. Staff had to be trained and it was only as men returned from the Services and completed their degrees that they became available. All this required time and it is only now (October 1951) that vacant posts are being filled. Nevertheless during this period a number of independent studies were undertaken. For example, "The Future of British Farming" (Pilot Press) by A. W. Menzies-Kitchin, "War-Time Changes in Two Groups of Eastern Counties Farms" by the same author and W. D. Chapman, *Economic Journal*, 1946, "Farm Accounting and Management (Pitman)" by F. G. Sturrock, "A Study of Milk Production in the Eastern Counties 1945-6-1947-8" by H. J. Butler and A. H. Scott.

As staff became available, however, new lines of research were developed. During the war the mechanisation of agriculture had increased and new technical practices had been introduced. But in spite of the influx of machines, there was little apparent reduction in the labour force on farms. It was therefore considered desirable to examine certain of these developments in detail with a view to ascertaining the labour and capital requirement and their place in existing farm organisation. This examination, moreover, would throw light on the problem of changes in the organisation of the farm as a whole or even in whole areas.

In this period, therefore, these new lines of research were inaugurated, particularly investigations into the use of labour on the farm. Projects included "Harvesting by Combine and Binder" (Farmers' Bulletin No. 9); "Threshing by British and American Machines" (Farmers' Bulletin No. 10); and the traditional and mechanised methods of handling farmyard manure (the results not yet published). In 1949 Report No. 32 on "Labour Organisation in Milk Production" was issued. This was based on the results of a survey of the tasks involved in milk production on 140 farms. In addition, T. Eastwood was appointed in 1946 to study, under the auspices of the Development Commission, the rural industries of the Province, and a report "Industry in the Country Towns of Norfolk and Suffolk" (Oxford University Press) was issued in 1951. Because of the scarcity and increasing costs of imported feeding stuffs, a study of the "Economics of Green Crop Conservation" (Report No. 38) was prepared by R. A. Mackness. This investigation studied the three main methods of conserving surplus pasture products for winter feeding in order to determine which was the best combination of capital and labour.

In order to compare agricultural labour use in certain areas of Great Britain and the United States of America, Dr A. W. Menzies-Kitchin visited the Middle Western States in 1949 under the auspices of the Economic Co-operation Administration. Report No. 36, "Labour Use in Agriculture" issued in 1951, brings into comparison the productivity of agricultural labour in the Eastern Counties of England and in areas of the U.S.A. broadly similar in climate and type of production. It also pointed to major problems of labour use requiring further study.

Research, in the next stage, will be concerned not primarily with individual enterprises but with the various possibilities of combining enterprises in the farm organisation. These possibilities will be influenced by new developments in machinery and technique. The objective is to give assistance in finding the most satisfactory farm organisation for any given set of circumstances.

PUBLICATIONS

Reports.

1. An Economic and Financial Analysis of Fourteen East Anglian Farms in 1923-24.
2. An Economic and Financial Analysis of Six Eastern Counties Farms in 1924-25.
3. An Economic and Financial Analysis of Fifteen East Anglian Farms in 1924-25.
4. An Economic and Financial Analysis of Four Eastern Counties Farms in 1925-26.
5. A Successful Norfolk Poultry Farm, 1922-26.
6. An Economic and Financial Analysis of Thirteen East Anglian Farms in 1925-26.
7. The Economy of a Norfolk Fruit Farm, 1923-26.
8. An Economic and Financial Analysis of Seven Eastern Counties Farms in 1926-27.
9. Sugar Beet in the Eastern Counties, 1927.
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14. The Seasonal Distribution of Farm Labour Requirements.
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38. Economics of Green Crop Conservation.

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1. Interpretation of Farm Accounts.
2. Financial Results of Farming in the Eastern Counties of England (Preliminary Statement for 1932).
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4. Farm Profits and Some Profitable Farms.
5. Management in Milk Production.
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7. Management in Pig Production.
8. Wartime Changes in Milk Production.
9. Harvesting by Combine and Binder.
10. Threshing by British and American Machines.
11. Economics of Pig Production ; Report for 1945-47.
12. Winter Feeding in the Dairy Herd.

*War Series Reports**

1. Pre-war Costs of Growing Strawberries.
2. Pre-war Costs of Growing Black Currants.
3. Pre-war Costs of Growing Raspberries.
4. Pre-war Costs of Growing Gooseberries.
5. Costs and Returns of Flax Growing, 1940.
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7. Costs and Returns of Sugar Beet Seed Growing, 1942.
8. Wheat Enterprise Costs.
9. Wheat Production on Marginal Land, 1941.
10. Wheat Production on Fen Soils, 1941.
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12. Costs of Growing Outdoor Tomatoes, 1942.
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27. Costs of Producing Brussels Sprouts in Bedfordshire, 1943-44.
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30. Further Wartime Changes in Milk Production.
31. Costs of Growing Barley in N.W. Norfolk and S.E. Cambridgeshire, 1944-45.
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33. Costs of Wheat Growing, in 1946.
34. Costs of Producing Sugar Beet in the Eastern Counties, 1946.
35. Costs of Producing Barley in the Eastern Counties, 1947.
36. Costs of Producing Potatoes in the Eastern Counties, 1947.
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AGRICULTURAL ECONOMICS

Changes in the Economic Organisation of Agriculture, 1948-9. Pp. 35.

Fm Econ. Br. Rep. No. 35, 1950. Price 5s.

The financial returns of 431 farms are compared for the years 1949 and 1948. The farms are the same in both years and are divided almost equally between eleven "type of farming" districts. Taking all districts together, the profit surplus in 1949 was reduced from the peak of 1948, i.e. from £5 6 10 per acre to £3 14 11 per acre. Only three districts—the Holland silts, North West Norfolk and Central Suffolk—showed higher profits than in 1948; no district made a loss.

In contrast to 1948 the summer of 1949 was dry. Grain yields were generally higher than in 1948 and crops were harvested earlier and more easily. But the effect of the drought was reflected in low yields of root crops, particularly in the light land areas.

Between the two years gross incomes rose slightly, largely as a result of a 27 per cent. increase in incomes from milk and livestock, particularly from pigs. This increase was due both to a rise in unit prices and in output.

There was a slight fall in receipts from corn crops, following a decrease in the acreage grown, while low yields of sugar beet and potatoes coupled with a fall in the acreage also resulted in reduced cash returns. In consequence the gross income from all sources only slightly exceeded that of 1948. An extra fillip to the 1949 gross income was derived from a very successful clover seed crop.

Over the whole sample gross charges rose by 10 per cent. between the two years, almost every item sharing to some extent in this upward movement. Labour costs per farm rose by 6 per cent. as a result of an increase in the minimum agricultural wage. Expenditure on feeding stuffs rose by 32 per cent. as a result of an increase in both purchases and prices. Except in the Breckland, however, the largest increases in gross charges occurred in implements and machinery, and appear to have been largely due to replacement of old or unsatisfactory equipment by new models and types.

Changes in the Economic Organisation of Agriculture, 1949-50. Pp. 31.

Fm Econ. Br. Rep. No. 37, 1951. Price 5s.

The data refer to an identical sample of 320 farms in 1950 and 1949, equally distributed between eight "type of farming" districts in the Eastern Counties.

In both years the net returns over the whole sample were sufficient to provide interest on the farm capital at 4 per cent., a reasonable wage for the occupier and a surplus amounting to £4 6 11d. per acre in 1950 and £3 12s. 9d. per acre in 1949 to remunerate the farmer for the risk of his undertaking. On the majority of holdings profits, in both years, were roughly similar, and there were relatively few losses.

The difference in weather conditions between the two years was very marked. The summer of 1950 was exceedingly wet with corn harvested under most difficult conditions, whereas 1949 was dry and harvest was uninterrupted by rain. There was little change in corn yields, but in 1950 quality was poor. There were record yields of root crops especially sugar beet, the quality of which in contrast to the previous season, was good.

Over the whole sample, the gross income increased by 10 per cent. due partly to a rise in commodity prices and partly to increased production. This upward movement was shared by all districts, but was relatively slight in the alluvial areas of the Isle of Ely and Holland Silts. The higher returns were mainly contributed by the income from wheat, sugar beet and pigs, but there was a substantial fall in returns from some crops—particularly clover seed, which was generally a failure in 1950.

The rise in gross income between the two years was largely counterbalanced by an increase of 9½ per cent. in gross charges. Almost every item of expense contributed to this change which was mainly due to higher prices. The subsidy which had been used to keep down the price of feeding-stuffs was removed in two stages and as a result the cost of decorticated cotton cake rose from £9 a ton in March 1949 to £29 in April 1950. The cost of many other foods followed a similar course. In like manner, the subsidy on fertilisers was reduced by half in July 1950 and will be eliminated in July 1951. As a result the unit cost of artificial fertilisers has risen but as the manuring of the 1950 crops was completed before this change took place, the effect is not apparent in this Report.

The outlay on repairs and replacement of implements rose considerably, for not only did many unit costs increase, but farms were becoming more heavily mechanised. For example, the number of tractors on these farms rose from 617 at the beginning of 1949 to 712 at the close of 1950 and the number of combine harvesters increased from 36 to 77. Mounted tractor implements are gradually replacing trailed types, while machines for lifting and topping sugar beet are becoming more widespread.

The average level of agricultural wage rates was almost the same in both years and there was practically no change in the number of manual workers employed. It would seem, therefore, that the extra work involved by the adverse summer of 1950 was done by mechanical aids.

Labour Use in Agriculture. Pp. 56.

Fm Econ. Br. Rep. No. 36, 1951. Price 5s.

Labour use is compared on farms of similar type in the Middle West of America and in the Eastern Counties. In both areas the farms are of medium size mainly engaged in arable farming with at least two and more often three livestock enterprises on every farm.

On balance, production per acre in terms of starch equivalent appears to be roughly the same in both areas, the higher yield from maize in the United States being offset by higher yields from wheat, barley, potatoes and sugar beet in the Eastern Counties.

Wage rates and rents paid by the American farmer were more than twice as high as in the Eastern Counties, but the U.S. farmer appeared to be able to buy implements and machinery for about one-third less than in this country.

Prices paid to the American farmer for his produce were generally lower than prices paid to farmers in this country, the main exceptions being the prices for fat cattle and potatoes. Potatoes, however, were not grown in the area under review.

The most striking difference between the two areas occurred in output per man which was between three and four times greater than in Britain. Output per man on the American farms was higher in both crops and livestock, but the comparative advantage was greatest in the case of crops. In Northern Indiana, for example, one man was responsible for 267 acres of harvested crops, compared with one man to 32 acres in the Eastern Counties.

This high output per man appeared in many cases to be the result of technical and organisational practices many of which could be applied in Britain.

These are discussed throughout the report and are summarised in the final chapter which also contains suggestions for future investigations.

A Study of Milk Production in the Eastern Counties 1945-6—1947-8. Pp. 52.

Fm Econ. Br. Rep. No. 34, 1950. Price 5s.

The average herd in the sample contained some 32 cows producing about 700 gallons per cow per year with production roughly equally divided between the winter and summer half-years.

Costs on the farm per cow rose from £59 in 1945-6 to £67 in 1947-8 and the costs per gallon from 20-1d. to 22-7d. There was a steady rise in all items of cost although food costs were at their highest in 1946-7 when the dry summer necessitated heavy hand-feeding.

Foods and grazing combined accounted for roughly half the costs, Labour for 31 per cent., Herd Replacement for about 7 per cent. and the Miscellaneous items for about 12 per cent.

Winter feeding cost twice as much per gallon as summer feeding and grazing.

The cost of labour increased each year by about 3d. per hour but this was partly compensated by a steady decrease in the number of hours per cow per year (203 in 1945-6, 198 in 1946-7 and 182 in 1947-8). On balance, the cost of labour which was £18 6s. per cow and 6-2d. per gallon in 1945-6 became £20 17s. and 7-0d. respectively in 1947-8.

Over the three years the average cost of herd replacement was £4 11s. per cow or a little over 1½d. per gallon. The effective herd life of an animal was 3½ years.

Profit per cow for an identical sample of 37 herds selling over 90 per cent. of their milk wholesale averaged £24 per year, and varied from £22 18s. in 1945-6 to £21 11s. in 1946-7 and £27 18s. in 1947-8.

A Survey of the Cost of Producing Potatoes in Two Districts in the Eastern Counties, 1949.

Fm Econ. Br. Mimeog. Rep. No. 42, 1950.

In Holland the average cost per acre of £75 13s. 11d. and average return per acre of £108 8s. 11d. were both over 20 per cent. higher than the corresponding values in Norfolk, which were £57 2s. 3d. per acre and £84 14s. 0d. per acre respectively.

Despite the dry season, good yields were obtained in both districts. Though costs have increased over previous years, returns per acre were sufficient to leave a substantial surplus. The abolition of the acreage subsidy and the increase in ware prices may be expected to lead to an increasing proportion of the total crop being grown in the higher yielding areas.

Winter Feeding in the Dairy Herd. Pp. 16.

Fm Econ. Br. Fmrs' Bull. No. 12, 1950. Price 2s.

This Bulletin covers 57 identical herds and among other things deals with trends in food cost and consumption, trends in derivation of feeding equivalents, and factors affecting food cost.

1080* CLAYTON, E. S.

Labour Use on an Identical Sample of 48 Farms in the Eastern Counties, 1939-1949.

Fm Econ. 1951, 6, 316-20.

This paper investigates the trend of labour requirements in relation to farm acreage on an identical sample of farms during the war and post-war years. Three areas were chosen where cropping and stocking patterns remained relatively stable to allow annual comparison of labour requirements. The results show a sharp fall in the efficiency of labour organisation throughout the war years, reaching a nadir in 1946, after which the trend was reversed. Labour efficiency increased for the remaining three years and in 1949 was half-way back to the immediate pre-war position.

An increase in tractor mechanisation in these sample farms was sustained over the period and it is suggested that the war-time fall in labour efficiency was associated with an inadequate use of the tractor force. By the same token better use of tractors partly accounted for increased labour efficiency after the war when the supply of newer, wider and mounted implements became available.

The remainder of the article deals with the amount of power available on these farms and it is shown that towards the end of the period, tractors were being used less intensively, facilitating the organisation of labour and consequently its more effective use.

1080* PLANT, S.

Horse Displacement and Land Liberation Resulting from the Introduction of a 'Standard' Tractor.

Fm Econ. 1951, **6**, 301-4.

An estimation of the number of horses displaced by a 'standard' tractor in Great Britain for the year 1948 was made by calculating the ratio of the average arable acreages cultivated by a tractor and by a horse. By this method a displacement ratio of 1 : 3.8 was obtained, compared with other recent figures varying between 1 : 3.6 and 1 : 5.

If in 1948 all the agricultural horses in Great Britain had been displaced by tractors, then, reckoning keep for a horse at 3 acres, 1,371,000 acres of land would have been liberated for other agricultural purposes.

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BALDWIN, G. G. **Mechanisation and Production.** *Golden Sheaf.* 1951, 8(1), 43-5.

1047* CLAYTON, E. S. **Tractor Use in the Eastern Counties.** *Pwr Fmr.* 1951, 6(5), 29-30.

1070* MENZIES-KITCHIN, A. W. **Local Administration of Agricultural Policy.** *Contr. to Lessons of the British War Economy.* Ed. by D. N. Chester. Camb. Univ. Press, 1951.

AGRICULTURAL ZOOLOGY (including Entomology)

1032* JONES, F. G. W.

Observations on the Beet Eelworm and other Cyst-forming Species of *Heterodera*.

Ann. Appl. Biol. 1950, **37**, 407-40.

An account is given of observations made between 1944 and 1948 on beet eelworm and related species of *Heterodera*. The host ranges of beet-, potato-, pea-, carrot- and *Galeopsis*-root eelworms were studied in the field, on sites where previous information had been obtained of the species of *Heterodera* present. The beet eelworm attacked plants in the Polygonaceae, Chenopodiaceae, Amarantaceae, Aizoaceae, Caryophyllaceae, Cruciferae, Onagraceae and Labiatae. Considerable differences were observed in the intensity of attack upon different hosts. The Cruciferae contains many efficient hosts and is the most important host family in the British flora. The *Galeopsis* eelworm, like the beet eelworm, attacked plants in several families, including the Chenopodiaceae, Caryophyllaceae and Labiatae, which also contain hosts of the beet eelworm. The other root eelworms were more specific, the carrot eelworm attacked only cultivated and wild carrots (*Daucus carota* L.), the potato eelworm attacked only plants in the genera *Solanum* and *Lycopersicum* (potato, *Solanum dulcamara* L. and tomato), while the pea eelworm attacked only peas (*Pisum*), beans and tares (*Vicia*). The potato eelworm did not attack *Solanum nigrum* L. or *S. sarrachoides* Sendt. and there was no evidence that potato eelworm is capable of attacking weeds in natural orders other than the Solanaceae. In pot-tests, the hop eelworm attacked only hops and nettles and the cabbage eelworm only plants in the family Cruciferae. The rates of development of cysts of the beet, potato, pea and carrot eelworms were studied in the field. In all four species, the rate of development was similar and varied with the soil temperature, being slow in spring, more rapid in summer, falling off during the autumn and becoming negligible during the winter. In the pea eelworm, drought caused delay in the invasion of rootlets by eelworm larvae and reduced the intensity of attack. Assuming adequate moisture, the maximum number of generations for all four species is between two and three per year. In practice, the number of generations is also governed by the vegetative period of the host crop. During the host-range trials and observations on rates of development, fresh cysts were examined in large numbers. Some differences in shape were observed between the larger cysts of the various species. There were also differences in colour and in the number of eggs extruded into the gelatinous egg sac. Analysis of length and breadth measurements suggested that size ranges and regression coefficients are somewhat more valuable than average lengths and breadths, and length-breadth ratios, which are usually given. The carrot-root eelworm (*Heterodera carotae* Jones) is described, and the status of the *Galeopsis*-root eelworm is discussed. The latter is distinct from beet eelworm and appears to be identical with a form found by Goffart in 1936, for which the name *Heterodera galeopsidis* is proposed. The observations here recorded do not support the theory of adaptability of root eelworms to new hosts.

1058* JONES, F. G. W.

The Sugar Beet Eelworm Order, 1943.

Ann. Appl. Biol. 1951, **38**, 535-7.

This article gives a brief account of the steps leading up to the issue of the Sugar Beet Eelworm Order 1943 and the way in which its provisions are being enforced. The Order arose from the results of surveys undertaken from the School of Agriculture under the direction of Mr F. R. Petherbridge. The aim of these surveys was to ascertain the extent to which eelworm had established itself in the important beet growing areas of East Anglia and to find ways of keeping it in check by rotational farming.

1053* WRIGHT, D. W., GEERING, Q. A. & DUNN, J. A.

Varietal Differences in the Susceptibility of Peas to Attack by the Pea Moth, *Laspeyresia nigricana* (Steph.).

Bull. Entom. Res. 1951, **41**, 663-77.

The variations in susceptibility of different varieties of peas to attack by the Pea Moth was investigated and an attempt made to determine and measure the factors concerned. Six varieties of peas differing widely in haulm length and earliness of maturation were used in each of two trials. In the first trial (sown 29th March)

the early maturing varieties came into flower before the moths were recorded on the crops and suffered the lowest attacks. The later varieties were exposed to attack over a much longer period and suffered the heaviest infestations. In the second trial (sown 3rd May) the attack was more uniform over all varieties with the early varieties more heavily affected than in the first trial; they were exposed to attack from the beginning of flowering until harvesting.

An estimate of the changes in the active moth population during the flight period was obtained and the varieties were compared in relation to the proportion of this population to which each had been exposed. There was a strong positive correlation between the degree of exposure and the incidence of attack on the different varieties.

The infestation of the varieties was also found to be influenced by the amount of cover which each provided; those with the most dense cover suffered the heaviest attacks.

Statistical analyses showed that the two factors, exposure and plant cover, were closely associated and exerted a joint influence on subsequent attack.

Data from other trials corroborated these findings and showed that strains of peas bred to mature early suffered substantially lower pea moth attack than did the later maturing types from which these had been bred.

AGRICULTURE

ENGLEDOW, F. L.

Report to the Minister of Agriculture and Lands on the Agricultural Development of Southern Rhodesia.

Pp. iv+132. 1950. (Government Stationery Office, Salisbury, Southern Rhodesia).

Principles for agricultural development in any country are suggested and these are then applied to the circumstances of Southern Rhodesia. After review of the physical factors, especially soil and rainfall, systems and practices of both European and African agriculture are examined. The contributions to agricultural output from veld grass and arable land are compared, inferences being drawn as to the relative parts these should play in the agricultural economy. Estimates of food production and requirements of all sections of the population are made, and the place of the important tobacco crop in the country's farming receives particular attention. Labour, becoming scarce in both Agriculture and Industry, is considered not only in connection with the possibilities of mechanisation, but also in relation to impending schemes for improvement of agriculture in the Native Reserves and modification of land tenure there.

Conclusions are drawn as to official policy for Agriculture and measures appropriate to them are discussed.

ENGLEDOW, F. L.

The Task of the National Agricultural Advisory Service.

3rd Tech. Conf. N.A.A.S., Cambridge, 1950.

In this review the duties of the Service are held to range from technical advice and experimentation on specific agricultural issues, through general assistance, when desired, in forming or changing the production policy of a farm, and so onwards to the National agricultural issues which, increasingly, interest the British farmer.

1077* RICHENS, R. H.

Crop Production in the Soviet Arctic.

Polar Rec. 1951, **6**, 227-36.

The following factors relating to agricultural practice in the Soviet Arctic are reviewed: the pattern of human settlement, methods of cultivation, the varieties of cereals, roots, green vegetables and forage crops grown and their origin, crop production under glass, and the economics of production.

OTHER PAPERS

ENGLEDOW, F. L. **An Address.** University of Nottingham, School of Agriculture Commemoration Day, 15 June 1950.

HANLEY, F. **The Farming of the Black Fens.** *Agriculture: J. Minist. Agric.* 1951, **57**, 173-6.

MANSFIELD, W. S. **Changes in East Anglian Farming.** "*Times*" *Survey of British Agriculture*, July, 1951, p. 3.

MENZIES-KITCHIN, A. W. **The Eastern Province.** *Agriculture: J. Minist. Agric.* 1951, **58**, 159-63.

ANIMAL BEHAVIOUR

1048* HAFEZ, E. S. E.

Mating Behaviour in Sheep.

Nature. 1951, **167**, 777-8.

The pattern of mating behaviour in the ewe was the same to rams of different breeds, but ewes of different breeds exhibited three different intensities of sex-drive. The intensity of the sex-drive of the rams was modified by the breed of the ewe and her size as well as other factors such as wool covering or its absence.

WALTON, A.

The Architecture of Male Sex Behaviour.

Proc. Brit. Soc. Anim. Prod. 1950, **13-14**, 5-13.

This article is mainly the same as recorded in the *Proc. Soc. Study Fertility*, 1950, **1**, 40-44 (Reprint No. 1015).

ANIMAL BREEDING AND GENETICS

1074* COCK, A. G. & PEASE, M. S.

The Genetics of the White Pile Pattern in the Domestic Fowl.

9th World's Poult. Congr., Paris, 1950. Off. Rep. 1, 49-53.

The accepted terminology, whereby *E* denotes the gene for full-black plumage, dominant to *e*, Columbian restriction, is unsatisfactory, since it confuses epistasis with dominance. *Se* (self) is therefore used to denote the gene for full-black; and *se* its normal allelomorph, producing black-red plumage, as in Brown Leghorns.

Crosses involving Indian Game (Dark Cornish), White Leghorns and Legbars have shown that birds carrying *I* (dominant white) normally have a pile pattern superimposed on the white. *Se* suppresses the pile completely in females, and partially in males. A double dose of *I* dilutes the pile.

Se suppresses also the buff markings present in the downs of most *I.i se.se* chicks, but greatly increases the frequency of chicks with black ticks visible in the down at hatching time.

In the presence of *I* and *Se*, and the absence of *B* (sex-linked barring), the shanks, although light at hatching become dark as the bird grows.

In certain families in which *Se* is not present, pile fails to appear in some of the *I.i* birds, but the gene or genes responsible for this have eluded analysis.

Of the white leghorns adequately tested, two have been *Se.Se*; nine *Se.se* and one *se.se*.

1038* HAFEZ, E. S. E.

Die Bruntzeit (breeding season) bei Schafen in Beziehung zur Tageslänge in nördlicher und südlicher Breite.

Naturwissenschaften. 1951, 38, 100-1.

The breeding season, as shown by the number of heat periods which actually occurred each month shown as a percentage of the possible heats, when the ewes were tried with a vasectomized ram are compared for the same breed, Border Leicester, in Northern and Southern hemispheres. While the relation of the breeding season in each case is in general related to the length of day-light hours, the midpoint of the breeding season occurs slightly before the shortest day, and this is more marked in Australia than in England.

1027* HAFEZ, E. S. E.

Sexual Season of the Ewe and Daylight Environment.

Nature. 1950, 166, 822-3.

The natural breeding season of six breeds was studied at Cambridge. Breeds, such as the Blackface, Welsh and Border Leicester, with a very restricted breeding season, of about 19 weeks with an average of 7 cycles per ewe, come from high altitudes and latitudes. Breeds, such as the Romney and Suffolk, with a medium length breeding season, of about 26 weeks with an average of 10 cycles, come from the southern counties, while breeds such as the Dorset Horn with a prolonged breeding season of about 32 weeks with an average of 13 cycles have probably originated still further south. The centre date of the breeding season coincided with the shortest day in all breeds but the Dorset Horn. The ovarian activity of ewe lambs lasted approximately only one-fourth to one-third of that of adults of the same breed. Within the breeding season, 7 per cent. of silent heats occurred, 62 per cent. of these occurring after the shortest day.

1043* HAMMOND, J.

Genetic Differences in the Composition of Animal Products.

Chem. & Ind. 1950, 166, 822-3.

The interplay between environmental and genetic factors is difficult to disentangle. In general the ultimate result on the product is determined by which is the limiting factor in the given set of circumstances. This is illustrated by the colour of butter fat and other examples. Reference is made to some genetic differences in the composition of milk, meat and eggs.

1075* PEASE, M. S. & COCK, A. G.

Retarded Pigmentation : a Recessive Gene affecting Down Colour and Pattern.

9th World's Poult. Congr., Paris, 1951. Off. Rep. 1, 63-7.

The recessive gene 'Retarded Pigmentation' was discovered in crosses between Light Sussex and Brussbars; it came originally from the Light Sussex.

Transferred to the brown stripe down of the Brussbar, this gene gives downs which are much paler than normal, the full pigmentation coming in only as the feathers grow. In combination with the Bar gene, the Retarded male chicks have light downs, and the females reduced brown stripe downs.

In the absence of the Bar gene, Retarded ordinarily gives reduced brown stripe in both sexes. Exceptionally it gives light or pale buffish downs, also in both sexes.

WALLEY, J. K.

X-rays in Pig Breeding : Use of X-rays for the Selection of Breeding Stock.

Vet. Rec. 1951, 63, 628.

It has long been known that, under constant environmental conditions, body length and thickness of back-fat of the pig are inherited to a high degree. Considering the importance of these two factors in bacon carcasses, any means of improving breeding stock for them deserves careful consideration and, if practicable in the field, the utmost exploitation.

Work over the last few years has shown quite definitely that X-rays (by films or direct screening) can be used to determine the rib number (as a measure of body length) and the thickness of the back fat in the pig.

For ease of X-raying, it is advised that the ribs are counted when the pig is under six weeks old—by preference in the first week. The thickness of the back-fat can be measured at any age and live-weight of the pig.

The back-fat measurement is best made when the gilts (or boars) are being finally selected for breeding, animals which have too much fat (for their age and live-weight) at the shoulder and/or loin being put to fatten off, the best only being retained in the breeding herd.

Selection of the best animals, for say carcass competition, in terms of body length and back-fat thickness could be made from a group of live animals in which other factors would appear to make them equally desirable as ultimate carcasses.

For the measurements described above the smallest portable veterinary X-ray unit (cost about £250 new) may be used by the breeder or his veterinarian to make this selection for the improvement of pig breeding herds.

OTHER PAPERS

- HAMMOND, J. **Some Aspects of Breeding Dairy Cattle.** *Proc. Dairy Conf. (Boots) Pure Drug Co., Thurgarton, Notts.*, 1951, pp. 91–107.
PEASE, M. S. **Chick Sexing.** *Poult. Guide & Yearb. Nat. Util. Poult. Soc.* 1951, **54**, 14–21.
PEASE, M. S. **Inbreeding and Outcrossing as the Breeder's Tools.** *Brit. Cattle Breed. Cl. Dig.* 1950, **6**, 34–44.
POMEROY, R. W. **The Breeding of Dairy Cows.** *Brit. Fmr.* 1951 (38), 11.
POMEROY, R. W. **General Principles of Animal Breeding: Inheritance Factors.** *Brit. Fmr.* 1951 (34), 10.
POMEROY, R. W. **General Principles of Animal Breeding: Pedigree and Inbreeding.** *Brit. Fmr.* 1951 (36), 13.

ANIMAL NUTRITION

1067* WOODMAN, H. E. & EVANS, R. E.

Nutrition of the Bacon Pig. XIV. The Determination of the Relative Supplemental Values of Vegetable Proteins (extracted, decorticated ground-nut meal) and Animal Protein (white-fish meal)

J. Agric. Sci. 1951, **41**, 102–40.

An account is given of the conditions that must be observed when making comparative determinations of the supplemental values of the proteins in the different protein concentrates that are commonly used in pig-feeding. In particular, it is shown that the comparison must be conducted over the period from weaning to about 90 lb. live weight. Measurements made in the later stages of growth can have no bearing on the problem of protein values, since supplementation of the basal mixture of barley meal and middlings with the protein-rich concentrates under comparison has no significant effect at this stage on the rate of growth or nitrogen retention.

The object of the present investigation was to compare the supplemental values of a typical animal-protein concentrate (white-fish meal) and vegetable-protein concentrate (ex. dec. ground-nut meal). The aim was to determine what percentage of ex. dec. ground-nut meal must be incorporated with a basal diet, composed approximately of 2 parts by weight of barley meal, 1 part of middlings (or fine bran) and a small allowance of lucerne meal and minerals, to promote the same rate of growth, or of nitrogen retention, in young pigs as is obtained with a standard diet containing roughly the same proportions of the basal foods in conjunction with 7 per cent. of white-fish meal, the diets under comparison being made up so as to contain equal percentages of "total digestible nutrients". It had been shown in earlier work that the diet containing 7 per cent. of white fish meal supplies the minimum amount of protein needed for the maximum rate of growth compatible with the available supply of net energy. The daily supply of food was scaled to live weight, and rose gradually from 2·1 lb. at 40 lb. live weight to 7 lb. per head at 200 lb. live weight.

On the basis of the results of pig digestion trials, 8 parts by weight of the ex. dec. ground-nut meal contained as much digestible crude protein as 7 parts of white-fish meal. The diets under comparison in the growth and balance trials were made up, therefore, to contain, respectively, 7 per cent. of white-fish meal and 8 per cent. of ex. dec. ground-nut meal. Their contents of crude protein, digestible crude protein and "total digestible nutrients" were approximately equal. If the proteins in these two forms of protein concentrate are equally effective for supplementing the proteins in the cereal part of the pig's ration, then both these diets should have been able to promote the maximum rate of live weight increase consistent with their content of net energy.

In the actual comparisons, however, pigs receiving the ration containing the ex. dec. ground-nut meal invariably made significantly poorer live weight gains, over the range of live weight from weaning to 90 lb., than those subsisting on the diet containing white-fish meal, and the results provided convincing evidence of the lower value of the ground-nut protein for rectifying the nutritive deficiencies of the proteins in the basal mixture of barley meal and fine bran. The results of the growth trials were amply confirmed by the results of the nitrogen-balance experiments.

A succession of growth trials and nitrogen-balance trials was next carried out in which the effect of increasing the level of ex-dec. ground-nut meal to 12, 14, 15, 16, 17 and 20 per cent. on the rates of growth and of nitrogen retention between weaning and 90 lb. live weight was investigated, equality in respect of "total digestible nutrients" being maintained in all the comparisons.

Only when the ex. dec. ground-nut meal was included in the diet at the 20 per cent. level did the young pigs receiving this diet give as good results in respect of rate of growth, efficiency of food conversion and rate of nitrogen retention as were obtained by the feeding of the standard diet containing 7 per cent. of white-fish meal. At this stage the diet supplying 7 per cent. of white-fish meal contained 14·2 per cent. of crude protein,

and of this, roughly one-third came from the animal-protein supplement, whereas the crude protein content of the diet supplying 20 per cent. of ex. dec. ground-nut meal rose to 18.5 per cent., of which slightly more than one-half came from the vegetable-protein supplement. On the two diets as so made up, equality in respect of rate of growth and nitrogen retention was only made possible, however, at the expense of a less efficient and more wasteful utilization of the ground-nut protein, as evidenced by the greater degree of de-amination and a correspondingly higher loss of nitrogen in the urine, of the protein in the ration containing ex. dec. ground-nut meal.

HALNAN, E. T.

The Nutritive (Energy) Value of Poultry Foods.

9th World's Poult. Congr. Paris, 1951, 2, 3-6.

Experimental evidence is given to support J. Axelsson's original suggestion that metabolisable energy is suitable as a basis for the measurement of the nutritive energy values of poultry foods and for its application to poultry feeding standards.

A method of calculating the metabolisable energy values of poultry foods from digestible nutrients is outlined, and, by use of factors reasonable accuracy between calculated values and experimentally found values is shown to occur. The recommended factors are, per gramme of digestible nutrients, in calories :— Protein 4.7, Fat from coarse fodders 7.8, Fat from cereal foods 8.3, Fat from oilseeds and animal products, 8.8, Carbohydrates 4.0.

OTHER PAPERS

BROOKES, A. J. **Calf Rearing.** *Brit. Cattle Breed. Cl. Dig.* 1950, **6**, 82-93.

POMEROY, R. W. **The Right Food at the Right Time.** *Fmr's Wkly.* 1951, **35(2)**, 57.

1037* WALLACE, D. B. **Fatten on Home-Grown Food.** *Fmr & Stk-Breed.* 1951, **65**, 403, 405.

ANIMAL PHYSIOLOGY (and Pathology)

1079* HAFEZ, E. S. E.

Inhibitory Action of Artificial Light on the Sexual Season of the Ewe.

Nature. 1951, **168**, 336.

Two series of experiments were carried out to inhibit the breeding season of the ewe by artificial light.

(a) Suffolk ewes were exposed to light continuously from 12th November when they were all on heat. They came off heat some 8 weeks earlier than the control group (average 21st January as compared with 17th March).

(b) Oestrus ewes of the Blackface, Border Leicester, Dorset Horn, Romney, Suffolk and Welsh were exposed to a constant daily ration of 16 hours light : 8 hours darkness starting on the 4th September. The latency of cessation of heat periods (from start of light treatment to date of last oestrus exhibited varied according to breed, the Blackface, Welsh, and Border Leicester having the shortest and the Dorset Horn the longest, with the Suffolk intermediate. The average for all was 15 weeks earlier than the controls. Breeds of sheep which originated near the tropics have a shorter time lag reaction to light than those breeds which originated near the poles. Younger animals are more readily influenced by artificial light than adults.

HALNAN, E. T. & HAMMOND, J.

A Course of Practical Physiology for Agricultural Students. 2nd ed. Pp. 124.

Camb. Univ. Press, 1950. Price 7s. 6d.

1031* HAMMOND, J.

Possible Causes for Physiological Sterility in Cattle.

Vlaams Diergeneesk. Tijdsch. 1950, **19**, 265-71.

In cows with apparently normal reproductive tracts, some 30 to 35 per cent. regularly fail to conceive either from normal matings or from insemination with adequate sperm. The following results may have a bearing on this fact :

Injectations with large doses of F. S. H., especially in the presence of luteal tissue in the ovary, leads to too rapid passage of the ova down the tubes. The result of this is that either the ova do not get fertilized, or if fertilized they pass to the uterus before it is in a properly receptive state, and degenerate there.

Degenerated fertilized ova and early embryos have been found in heifers with quite normal reproductive tracts.

Ova can be "tube-locked" by excess of oestrogens and speeded up down the tract by excess progesterone.

The theory is suggested that in many cows there is a slight abnormality in the oestrogen-progesterone level in the blood which causes such difficulties in conception. Methods of measuring oestrogen and progesterone levels in the blood are required, however, before proof of such a theory, or a method of diagnosis, can be obtained.

HAMMOND, J.

Summary of the Veterinary Standpoint.

Contr. to *Toxaemias of Pregnancy : Human and Veterinary.* J. & A. Churchill, London, 1950, p. 265.

From the various symptoms of the toxaemias described in the papers given at the Conference it would appear that they are deficiency diseases in an acute form.

1036* HANCOCK, J. L.

A Staining Technique for the Study of Temperature-Shock in Semen.

Nature. 1951, **167**, 323.

Using a staining method for the differentiation of living and dead spermatozoa, it was shown that an estimation of the resistance of test ejaculates of bull semen to temperature-shock could be obtained by plotting the proportion of spermatozoa surviving shock against the temperature of the stain. It was suggested that the method might be applied as a simple test for the preliminary investigation of many aspects of the phenomenon of temperature shock.

1033* HART, D. S.

Photoperiodicity in Suffolk Sheep.

J. Agric. Sci. 1950, **40**, 143.

A gradually decreasing plane of light and increasing plane of darkness is not an essential factor for stimulating the onset of oestrus in sheep.

Sheep being short-day breeding animals, a standard and regularly maintained rhythm of short-light and long-dark will stimulate the onset of oestrus.

The terms short and long are used in the relative sense only, since their significance is solely a means of supplying the necessary contrast impulse to the pituitary gland.

A ratio of 1 part of light to 2 parts or more of dark is sufficient to supply the contrast effect.

Oestrous cycles induced by artificial light rhythms appear to be normal in all respects, conforming to the normal intervals between heat periods and associated with the ovulation of normal ova.

The anoestrus period varies in depth, and sheep which have just entered it may be brought back into oestrus very much faster than animals which are in deep anoestrus.

The milk yield of lactating ewes does not appear to be unduly depressed by the onset of oestrous periods induced by an artificial light-dark rhythm.

1051* HART, D. S.

Photoperiodicity in the Female Ferret.

J. Exp. Biol. 1951, **28**, 1-10.

Evidence accumulated during two years' work and experience in photoperiodicity in ferrets suggests the following conclusions:

Oestrus or anoestrus may be induced by influencing the activity of the pituitary gland; this is effected through a contrast-sensitive mechanism which is stimulated by light: dark sequences. The total daily quantity of light is not the controlling factor.

In order to obtain the long-light: short-dark ratio necessary for an oestrus-activating sequence, the ratio should be in the proportion of two parts or more of light to one part darkness and reversed if it is desired to induce a state of anoestrus.

Slowly increasing or decreasing planes of light are not an essential part of an oestrus-activating sequence.

Because ferrets can be brought into anoestrus quicker than they can be brought into oestrus it is considered that the sexual season curve is more acute when entering anoestrus than when entering oestrus.

Doubling the number of light-dark contrast stimuli from one every 24-hour period to two every 24-hour period produced no acceleration of the onset of oestrus nor any indication of a 'tetanus effect'.

1062* MAQSOOD, M.

An Abnormality of Mammalian Spermatozoa.

Experientia. 1951, **7**, 304.

In inbred buck rabbits of low fertility semen samples showed that a small percentage of the sperm heads had protoplasmic masses instead of tails and a number of the seminiferous tubules showed arrested spermatogenesis.

1029* MAQSOOD, M.

Determination of Rate of Secretion of Thyroxine in the Male Rabbit.

Nature. 1950, **166**, 735-6.

The rate of secretion of thyroxine was measured in rabbits of different ages (4-48 weeks) by injection of varying amounts of L-thyroxine daily into animals which were fed with 0.1 per cent. thiouracil daily for 4 weeks. This latter prevents the synthesis of thyroxine by the thyroid gland. The resulting lowered thyroxine level in the blood stimulates the secretion of thyrotrophin which in turn causes enlargement of the thyroid. By injecting graded doses of L-thyroxine into thiouracil fed animals, the weight of the thyroid is reduced proportionally to the thyroxine dosage. The weights of the thyroid in such treated animals are then compared with the weights of controls to give the rate of secretion in the normal animal.

1040* MAQSOOD, M.

Effects of Hypo- and Mild Hyper-thyroidism on Fleece Growth in Sheep.

Nature. 1950, **166**, 647.

Eight Suffolk ram lambs of 4 months old were used. Group 1 were given thyro-active iodinated casein in the ration within the physiological range. Group 2 were thyroidectomized or given thiouracil, while group 3 were controls. Mild hyperthyroidism increased while hypothyroidism decreased fibre length without affecting the fibre diameter.

1039* MAQSOOD, M.

Effects of the Thyroid, Castration and Season on Adrenals in the Male Rabbit.

Nature. 1951, **167**, 323.

Administration of thyroxine 40 per cent. above the estimated rate of secretion resulted in an increase in the weight of the adrenals while treatment with thiouracil caused a decrease. Castration causes an increase after 24 weeks. Winter weights are above summer weights.

1050* MAQSOOD, M.

Influence of the Thyroid Status on Body Growth.

Experientia. 1951, **7**, 150.

Administration of L-thyroxine in amounts 40 per cent. above the estimated normal thyroxine secretion accelerated the growth rate of young male rabbits and a ram and this was continued if the dosage of thyroxine administered was reduced as the normal secretion rate increased with advancing age, thereby maintaining the thyroxine level within the optimal physiological limits. Growth retardation was observed by increasing the dosage of thyroxine with advancing age, or by administration of thiouracil to young rabbits and rams.

1042* MAQSOOD, M.

Influence of the Thyroid on Body Temperature of Growing Animals.

Nature. 1951, **167**, 356.

The increase of body temperature resulting from the administration of large doses of thyroxine to rabbits and rams was proportionally higher in summer than in winter. Continuous thiouracil feeding or thyroidectomy decreased body temperature.

1061* MAQSOOD, M.

Observations on Staining Affinity and Morphology of Mammalian Spermatozoa.

Experientia. 1951, **7**, 303.

In ram semen smears stained with Romanowsky stains, the galea capitis of a few of the sperm were more deeply stained than the rest of the sperm. When ram semen samples were submitted to temperature shock and stored the galea capitis presented a granular appearance and some sperm showed a depression at the anterior end of the sperm head. This condition was observed during the spring season when the ram begins to show a seasonal decline in reproduction.

1028* MAQSOOD, M.

Role of the Thyroid in Sexual Development in the Male.

Nature. 1950, **166**, 692.

Experiments with young male rabbits and rams showed that mild hyperthyroidism within the physiological range increased the growth and function of the testis and sex-drive, whereas thyroidectomy or treatment with thiouracil interfered with spermatogenesis and sex-drive.

1081* MAQSOOD, M.

Thyroxine Therapy in Male Subfertility.

Nature. 1951, **168**, 466-7.

The results suggested that one of the causes of low fertility in buck rabbits is a decrease in the rate of secretion of thyroxine which occurs with advancing age. The administration of moderate doses of thyroxine greatly improved sexual desire and sperm production.

MARDEN, W. G. R.

The Hormone Control of Ovulation in the Calf.

J. Physiol. 1951, **115**, 22-3P.

Subcutaneous horse anterior pituitary injections (F.S.H.) given every 12 hr. for 3-4 days can produce follicular development in the calf as early as the first week after birth. After the first few days of extra-uterine life there occurs no further increase in ovarian response to F.S.H. The calf at 3 weeks responds as well as animals at 20 weeks. Ovulation can occur spontaneously in the calf at less than 3 weeks after birth, provided the follicles have been stimulated by F.S.H. However, the number of ovulations is small when compared with the number of large follicles developed. Intravenous injection of H.C.G. (human chorionic gonadotrophin) or cattle anterior pituitary extracts high in L.H. will not substantially increase the number of ovulations obtained from calves receiving only one series of F.S.H. injections. Superovulation with the formation of multiple corpora lutea can be obtained in the immature calf by repeating the original F.S.H. treatment after an interval of 15 days and then giving a subcutaneous injection of L.H. at the 21st day. The rate of descent of ova in the uterine tube in the calf is not substantially influenced by the age of the animal, but is greatly accelerated by the presence of an active corpus luteum at the time of the L.H. injection.

1052* ROBINSON, T. J.

The Control of Fertility in Sheep. I. Hormonal Therapy in the Induction of Pregnancy in the Anoestrus Ewe.

J. Agric. Sci. 1950, **40**, 275-307.

Four experiments dealing with attempts to induce pregnancy in the anoestrous ewe during the summer of 1948 are described. While little has been accomplished towards a practical solution of the problem of regularly inducing such pregnancies, some light has been thrown on reasons for past failures and erratic results. The following conclusions are drawn :

In the absence of a spontaneous corpus luteum, ovulation without heat may be induced in anoestrus by 800 i.u. P.M.S.

In the presence of a waning corpus luteum ovulation with heat may be induced in anoestrus by 800 i.u. P.M.S.

In the presence of an active corpus luteum neither ovulation nor heat is induced in anoestrus by 800 i.u. P.M.S. Occasionally, however, heat may occur without ovulation and with the formation of grossly cystic ovaries.

In mid-anoestrus ovulation is not regularly induced by 800 i.u. P.M.S., due presumably to very low pituitary and ovarian activity.

Anoestrus in the ewe is a relative rather than an absolute quiescence, and it is suggested that there is a rhythm of pituitary activity roughly inversely related to the daylight/dark rhythm, deep anoestrus occurring about the time of the longest day. Thus at different stages of anoestrus, different response to the same treatment may be expected in accordance with the proportion of animals falling into the categories 1-4 above.

Artificially formed corpora lutea are apparently perfectly normal as regards size, colour, and function.

Treatment with P.M.S. alone is sufficient to cause follicular maturation, ovulation and corpus luteum formation. There is some evidence, however, that the anoestrous ewe has some difficulty in ovulating all the follicles matured. The subcutaneous use of Prolan does not alleviate this difficulty, but injection of stilboestrol at about the time ovulation is due, may have some effect.

The mean ovulation rate of ewes ovulating after 800 i.u. P.M.S. is usually rather higher than the normal for the breed and many cases of definite multiple ovulation have been observed. For this to occur the presence of an old corpus luteum is not necessary. A maximum of six ova have been shed.

In mid-anoestrus Welsh ewes show a higher resistance to P.M.S. action than do Suffolks, both as regards numbers ovulating and ovulation rates of those responding.

Injection of P.M.S. in increasing divided doses is no more effective in inducing heat than is a single injection. Ovulation without heat occurs as soon as a certain threshold of stimulation (probably about 400 i.u.) is reached.

Previous findings have been confirmed that, unless modified by the presence of a spontaneous corpus luteum, ovulation will normally occur within 48 hr. of injection.

When 35 mg. testosterone propionate is administered 24 hr. before 800 i.u. P.M.S., heat, usually without ovulation, will occur in a high proportion of ewes. Where ovulation does occur it rarely coincides with heat.

When testosterone propionate is injected with or after P.M.S. the results are much more variable, depending upon whether or not it is absorbed in time to play a role.

Testosterone propionate, while inhibiting ovulation, does not inhibit follicular development.

Testosterone propionate has no oestrogenic effect. Its action in inducing oestrus in conjunction with P.M.S. has been discussed.

The low percentage recovery of fertilized ova following service is attributed to faulty timing between service and ovulation in some cases. In others it may be due to either the ova being potentially unfertilizable or to the uterine and tubal environments being unsuitable for transport of sperm and fertilization. The latter view is favoured.

When heat and ovulation occur as a result of P.M.S. injection in the presence of a waning corpus luteum, normal service, sperm transport and fertilization occur.

1068* ROBINSON, T. J.

The Control of Fertility in Sheep. II. The Augmentation of Fertility by Gonadotrophin Treatment of the Ewe in the Normal Breeding Season.

J. Agric. Sci. 1951, **41**, 6-63.

In the course of two breeding seasons 137 mature to aged ewes of mixed breeds but predominantly Border Leicester \times Cheviots, Dorset \times Cheviots, Suffolks and Hampshires and their crosses, have been injected with P.M.S. or P.U., and at different levels of dosage, and slaughtered at intervals after service to determine the sequence of events following treatment. In addition ten ewe lambs received similar treatment and eighty-one flock Suffolk and Romney Marsh ewes, of which forty-nine were injected, have been studied. The results may be summarized as follows :

The injection of 500-2000 i.u. P.M.S. on the 12th day of the oestrous cycle will regularly induce multiple ovulations at the ensuing heat.

There is a significant dose-response relationship between 500 and 2000 i.u. P.M.S. Mean ovulation rates observed were : 500 i.u., 4.1 ; 1000 i.u., 10.6 ; 2000 i.u., 15.8. There is, however, considerable variation, the ranges being 2-9, 4-33, and 8-29 respectively.

The injection of 1000 i.u. P.U. subcutaneously on the 12th day of the cycle causes marked ovarian and cyclic abnormalities, and heat may be entirely suppressed. When injected intravenously at heat following a priming injection with P.M.S. on the 12th day there is no evidence that it increases the rate of ovulation ;

in other words, the ewe can ovulate up to at least thirty ova without difficulty, provided the follicles are matured.

P.M.S. levels of 500 and 1000 i.u. do not cause any apparent ovarian abnormalities apart from super-ovulation. A very high proportion of all follicles developed rupture and form apparently normal corpora lutea. P.M.S. at 2000 i.u. causes lutein cysts and ovulation may be inhibited.

P.M.S. at 500 and 1000 i.u. causes no cyclic abnormalities, although cycle length is slightly shortened. In the event of the ewe failing to conceive, the subsequent oestrus is normal, and ovulation and fertilization of the ova occur.

Commercial P.M.S. is probably as effective as fresh P.M.S. provided it is correctly standardized. There seems no reason to suspect differences in multiple ovulating efficiency between different batches of fresh P.M.S.

While breed differences in response possibly exist they were not observed in these experiments. Nor were differences apparently related to the relative time of injection within the breeding season.

There is an ovarian weight-P.M.S. level, dose-response relationship which is almost entirely accounted for by the numbers of corpora lutea and hence of luteal tissue.

Multiple-ovulated ova are highly fertilizable. However, when fifteen or more are shed the rate of tubal transport is considerably accelerated and the proportion fertilized appears to fall. One- and two-cell ova have been recovered from the uterus within 48 hr. of service. Nine fertilized ova have been recovered from one ewe.

Considerable embryonic mortality occurs before attachment of the blastocysts. None the less, multiple impregnation does occur but is followed by further early death. Up to thirteen attachments have been observed in one ewe, but all but three were showing signs of regression by the 19th day.

Post-attachment mortality takes the form of an initial retardation commencing about the 15th day, embryos apparently dying a day or so later. The peak of mortality occurs between the 17th and 19th day, by which time definite signs of resorption are apparent.

By 21 days equilibrium has been reached, the mean numbers of survivals of those ewes pregnant being some 260 per cent. This level is maintained without further loss until the 68th day. Several cases of four normal foetuses were noted up to the 41st day, and one uterus containing six perfectly normal foetuses was recovered at 61 days.

The overall fertility indicated by these slaughterhouse ewes varies with the level of P.M.S. administered. While equilibrium is achieved by all animals conceiving, at about 250-260 per cent. viable foetuses, regardless of the dose injected, there is an increasing proportion of returns to service with increasing dosage. For the most part this appears due to hormonal imbalance at the time of ovulation and fertilization when an excessive number (>15) of ova are shed. This results in accelerated ovum transport through the tubes and lowered rate of fertilization. Between ovulation rates of 4 and 12, as produced by 500 i.u., rate of conception is extremely high. Of twenty-five ewes receiving 500 i.u. P.M.S., twenty-three (92 per cent.) conceived to the first fertile service. The conception rates were reduced to 80 and 60 per cent. by 1000 and 2000 i.u. respectively.

Although after the end of the 3rd week there is no direct evidence of further foetal mortality, the percentage of lambs born in the flock ewes injected with 500 i.u. P.M.S. was only 192 per cent. of those lambing or 167 per cent. of all ewes mated (147 per cent. for controls). This indicates a loss late in pregnancy. This can in part be accounted for by abortion; one ewe aborted, due, it is believed, to her carrying more lambs than she was physically capable of retaining.

Of fifteen flock Suffolks injected in the 2nd year with 500 i.u. P.M.S., thirteen lambed, one aborted and one did not conceive. The thirteen ewes lambing presented twenty-five lambs, including one set of triplets and one of quadruplets. All the latter were viable, but two sets of twins were born dead. One triplet was lost on fostering and one other lamb was lost, so nineteen were tailed. Of fifteen controls, all lambed, giving twenty-one lambs born of which twenty survived. Conception of first fertile service was higher in injected than in the control ewes. In the preceding year when 1000 i.u. was given, both conception and lambing rates were appreciably lowered as compared with untreated controls. The significance of this in respect to the level of P.M.S. administered is stressed.

It is concluded that the major part of the embryonic loss is due to a uterine environment which is incapable of supporting more than a limited number of embryos. It is considered possible that there are breed differences in this, and that each breed, and individual within the breed, has a 'Maximum Potential Fertility'.

This 'Maximum Potential Fertility' is not attained in normal breeding practice, since the number of ova shed by the ewe tends to constitute a limiting factor. Use of a level of P.M.S. which will induce between three and ten ovulations—in the case of this experiment, 500 i.u.—removes this limiting factor, giving the individual full opportunity to express its full potential breeding capabilities.

There is some indication that the use of P.M.S. in lambs may not give good results, and its use for the while should be restricted to mature ewes.

Since 500 i.u. P.M.S. has resulted in a higher conception rate to first service and to a greater number of lambs born, it is apparent that this technique of injecting on the 12th day of the cycle a level of P.M.S. which will result in a moderate number of ovulations is worthy of exhaustive field trials, notwithstanding the high post-natal mortality observed in the few cases which were allowed to go to term.

In view of the higher indicated fertility of the slaughtered ewes which were mainly Border Leicester cross and Dorset x Cheviots—normally very highly fertile ewes as compared with the flock Suffolks—it is considered possible that this technique will yield best results with more highly fertile breeds.

To have any hope for successful increase of fertility in mammals following gonadotrophin treatment the hormone must be administered at a time and at such a concentration that it will augment, but not upset, normal hypophyseal and ovarian function.

ROBINSON, T. J.

Reproduction in the Ewe.

Biol. Rev. 1951, **26**, 121-157.

A review of the literature concerning the effects of gonadotrophin hormones on the ewe, with reference to modifications of the breeding season and fertility.

1063* ROWSON, L. E.

Methods of Inducing Multiple Ovulation in Cattle.

J. Endocrinology. 1951, **7**, 260-70.

Follicles in relatively large numbers (average 26) have been consistently produced by the injection of 3600 and 4500 i.u. of whole pregnant mares' serum, and to a slightly lesser degree (average 14), by the injection of similar amounts of commercial processed pregnant mares' serum.

Ovulation after this treatment has been spontaneous, but to a lesser degree when using the processed material (5.4 per cent. ovulations) than when using the whole plasma (24 per cent. ovulations).

The percentage of ovulations after this treatment has been increased by the intravenous injection of chorionic gonadotrophin at a dosage of 2000 i.u. (22 per cent. for processed material and 42 per cent. for whole serum). Where a large corpus luteum was present in the ovary during the time of treatment, the percentage ovulations was 52 as compared with only 14 in those cases in which no corpus luteum was present.

Injections of 20 mg. progesterone daily for 4 days after removal of the corpus luteum, and after the P.M.S. injections, had the same effect on the ovulation rate (55 per cent. ovulations) as the presence of a large corpus luteum.

Ova produced by either processed or whole serum can be fertilized fairly readily in the absence of a corpus luteum, but in its presence or after daily injections of progesterone, no fertilization takes place.

In the presence of a corpus luteum or after injections of progesterone, the ova travel down the Fallopian tube at a greatly increased rate, but were in some cases slowed up by the injection of oestrogens.

1054* WALTON, A.

Activity of Spermatozoa *in vitro*.

Proc. Soc. Study Fertility. 1950, **2**, 63-5.

In this paper are described some factors affecting survival of the spermatozoa *in vitro* which as far as we know are not directly related to the enzymic processes of sperm metabolism. These factors are (1) the protective action of egg yolk in maintaining respiratory activity, (2) the dilution effect which appears to depend upon the elution of some protective substance from the spermatozoon, and (3) temperature shock which has a detrimental effect on survival but can be prevented by constituents in egg yolk.

OTHER PAPERS

1083* MAQSOOD, M. **Influence of the Thyroid on Body Temperature of Animals.** *J. Physiol.* 1951, **115**, 22P.

1055* POMEROY, R. W. **Piglet Mortality.** *Pig Breed. Gaz.* 1951, **66**, 29-31, 33.

ANIMAL PRODUCTION

HAMMOND, J.

Livestock Improvement. Pp. 76.

Seale-Hayne Agricultural College, 1950. Price 2s. 6d.

A series of lectures delivered under the Devon County Agricultural Association Lectureship. Sections are included on General Principles of Animal Improvement, Dairy Cattle, Beef Cattle, Sheep, Pigs and Poultry, while a short account is given of the discussions which followed the lectures.

HAMMOND, J.

The Influence of Nutrition on Animal Production.

J. Inst. Corn & Agric. Merch. 1950, **2**, 165-176.

A discussion of the ways in which the plane of nutrition affects animal production with special relation to certain critical periods during the animal's life, such as before mating on fertility, during the latter part of pregnancy on the strength of the young at birth and on milk yield, and, in early life, for the production of meat and the control over the proportions and composition of the body.

HAMMOND, J.

Measuring Growth in Farm Animals.

Contribution to "A Discussion on the Measurement of Growth and Form". *Proc. Roy. Soc. 'B'*. 1950, **137**, 452-61.

Changes in the form and composition of the body as the animal grows up are caused by the different parts and tissues of the body growing at different rates. An overall measure of the changes taking place in form can be made photographically, eye-ear length being used as a base line when embryonic stages are considered, while shoulder height is used when post-natal stages are being compared. Studies of the control of growth and form by nutrition lead to a theory of the partition of nutrients to the different tissues of the body according to the order of their development in the individual or to their metabolic activity. The control of body form by the control of nutrition at different phases of the animal's life enables one to separate chronological age from anatomical and physiological age.

1073* HAMMOND, J.

The Practical Use of Hormones in Animal Production.

Meded. Landb. Hogesch. Opzoekingssta. Gent. 1950, **15**, 770-87.

European Ass. Anim. Prod. Publ. No. 1. 1950, pp. 8-28.

An account of recent research. Reference is made to the use of the gonadotrophic hormones F.S.H. and L.H. by injection and their stimulation by changes in the daily light-dark rhythm in seasonal breeding animals. Their effect on increasing fertility beyond a certain point is limited by foetal atrophy, but their effects may be exploited in the future by the transplantation of fertilized ova. The effects of the sex hormones oestrogen and progesterone are discussed and the effects of implants of the synthetic oestrogen stilboestrol on the development of the mammary gland are described. Short references are also made to oxytocin, the "let down" of milk-hormone, and to the effects of the anterior pituitary growth hormone and thyroxine on growth.

1045* BROOKES, A. J. & VINCETT, L. S.

Beef Production Experiment at Cambridge.

J. R. Agric. Soc. 1950, **111**, 99-118.

The experiment on beef production in progress on the University Farm is described in this interim report. The aim of the experiment is to compare the growth and development, the food consumption and final carcass quality of three types of cattle (beef, dual-purpose and dairy bred steers) reared on four different feeding treatments, and to establish the relative importance of breed and nutrition in the production of beef. The four feeding treatments are high-high, high-moderate, moderate-high and moderate-moderate, in which the initial high or moderate level is maintained from birth to eight months. Subsequently the high or moderate level applies to winter feeding only, all groups spending the summer periods at grass. The experiment was commenced in 1946, and in order to obtain results that are sufficiently reliable it will be continued for another five years. The first three complete batches of cattle have yielded some interesting data on the effects of the feeding treatments on liveweight increase, food consumption and profitability.

The main conclusion is that the nutrition during the calf stage influences the development of the animal throughout its life. A little good food fed to a young animal, when the maintenance requirement is low and growth is made most economically, is of far more value than a great deal of food fed to the older animal. The better the calf is fed the sooner it will reach the stage when it is able to utilize the cheaper bulky foods. The eight months of high feeding in the calf stage enables a high-moderate to fatten a year earlier than a moderate-moderate. A moderate-high bullock requires 43 per cent. more of the expensive concentrated foods than a high-moderate, and is even then a lighter weight at slaughter.

The relative profitability of the four feeding treatments is fairly clear. Neither the high-high nor moderate-high systems of feeding can be recommended for present-day conditions. The high-moderate and moderate-moderate cattle both make a reasonable profit per head, but the shorter life of the high-moderates gives them a higher annual profit than the moderate-moderates. The high-moderate treatment appears to be the most suitable for rearing beef cattle to-day because it produces a moderate-sized carcass in a short time, it uses only a little concentrated food and makes the fullest use of cheap bulky foods and it leaves the highest profit for the farmer.

BROOKES, A. J.

Some aspects of Rearing Cattle for Beef.

J. Fmrs' Cl. 1951, Pt. 5.

In this paper a popular account of the beef production experiment on the University Farm is followed by a discussion of the application of some of the results to farm practice in rearing cattle for beef.

OTHER PAPERS

HAMMOND, J. **Dual-Purpose Herds for More Beef.** *Fmr & Stk-Breed.* 1950, **64**, 3273.

HAMMOND, J. **Rapporti tra Funzione della Riproduzione e Nutrizione.** *Riv. Zoot.* 1950, **23**, 354-5.

HAMMOND, J. **Scientific Developments in Animal Husbandry.** *Agriculture: J. Minist. Agric.* 1951, **58**, 81-5.

POMEROY, R. W. **Bull Management and Fertility.** *Farming.* 1950, **4**, 374-5, 378.

POMEROY, R. W. **We Must Preserve our Early-maturing Breeds.** *Dairy Fmr.* 1951, **24**(9), 40.

PLANT BREEDING AND GENETICS

1026* BAINS, G. S. & HOWARD, H. W.

Haploid Plants of *Solanum demissum*

Nature. 1950, **166**, 795.

Three haploid plants of *Solanum demissum* were obtained from crosses of this hexaploid species with diploid species. At meiosis in one of these haploids, which have 36 chromosomes, up to 8 bivalents per nucleus were seen in preliminary observations.

1060* BELL, G. H. D.

Barley Breeding and Related Researches.

J. Inst. Brew. 1951, **57**, 247-60.

The systematic botanical and biological background of barley determine that many of the newer techniques of breeding are hardly applicable to the improvement of this crop. The comparatively isolated taxonomic

position gives little scope for intergeneric hybridisation or the exploitation of artificial amphidiploids. Auto-polyploidy and the artificial induction of mutations by X-rays are more hopeful, and these techniques are being employed.

It is, however, to inter-varietal hybridisation within the scope of particular botanical forms that barley improvement has owed so much in the past, and will have to continue to turn. There has, however, been a tendency in England to restrict the parental material used so that there has been surprisingly little progress in the improvement of malting barleys during the last 20 years. The use of foreign—particularly N.W. European—varieties for hybridisation with native English varieties has resulted in improvement in various character combinations in two-row spring and winter malting types, and there is great scope for further advances by combining better field characters with the superior malting quality of native varieties. In addition, attention is being paid to improving mildew resistance, while disease resistance in general must be kept to the fore. It is also desirable to breed both spring and winter varieties suitable for feeding purposes.

1034* BELL, G. D. H.

Investigations in the Triticinae. I. Colchicine Techniques for Chromosome Doubling in Interspecific and Intergeneric Hybridisation.

J. Agric. Sci. 1950, **40**, 9–18.

Sixteen colchicine treatments, involving five main methods of application and six concentrations were used on interspecific *Triticum* hybrids and *Triticum-Aegilops* and *Triticum-Agropyron* intergeneric hybrids. The efficacy of the major treatments was assessed in terms of plant survival, plant fertility and ear fertility, the most successful method of application being absorption of the colchicine through the cut leaves by inverting a phial containing colchicine over cut back tillers. By this means chromosome doubling was obtained in fifteen *Triticum* interspecific crosses, thirty-four *Triticum-Aegilops* crosses, and one *Agropyron-Triticum* cross.

Complete fertility was not obtained in crosses which set grain as the result of chromosome doubling, individual plants showing ears varying from complete sterility to virtual complete fertility. Evidence was obtained of differential cross response to colchicine action, and also of cross-group response to particular treatments. Particular parental combinations appeared to be more easily induced to double the chromosomes and produce grain than were others, while there was an indication that every cross may have a colchicine technique to which it is particularly suited.

BIFFEN, R. H.

The Auricula.

Pp. 164+7 Plates. Camb. Univ. Press. 1951, Price 15s.

HAWKES, J. G.

Algunas observaciones sobre la papa del Ecuador. (Some observations on the Ecuadorean potato).

Flora, Quito. 1950, **7** (17–20), 93–96.

A description of the wild and cultivated potatoes of Ecuador, and of the potato diseases and insect pests observed in that country during a brief journey there in August, 1950.

1044* HAWKES, J. G.

The Commonwealth Potato Collection.

Amer. Potato J. 1951, **28**, 465–71.

An account is given of the history and development of the Commonwealth Potato Collection from the first South American potato collecting expedition in 1939 up to the present time. Until 1951, when the Agricultural Research Council assumed responsibility for it, the Collection was under the control of the Commonwealth Agricultural Bureau.

Amongst other things mention is made of the tests carried out for resistance to blight, virus diseases, eelworm, and frost. Studies were also made on the biochemical properties and photoperiodic response, whilst a taxonomic survey with some cytological and breeding work was also effected.

A brief note is added on the recent collections of wild potatoes made by the writer in Mexico and Colombia, and on the latest developments in genetical and cytological work.

HAWKES, J. G. & RONAS PEÑA, E. DE (Editors).

Conferencia Latino-Americana de especialistas de papa. (Latin American Conference of Potato Specialists).

Minist. Agric. Gan., Bogotá, Colombia, 1950. Pp. 78 (mimeographed).

In August 1950 an Inter-Latin American conference was held in Bogotá, Colombia, of potato breeders and others under the auspices of the Ministry of Agriculture of that country and of the Rockefeller Foundation. Besides the Colombian members, delegates from Peru, Bolivia and Chile also attended. Although most of the papers dealt with potato breeding, other topics such as potato diseases, agronomic studies, fertilizer trials and seed certification were treated. Amongst the conclusions and resolutions adopted, it was agreed to hold the next conference in Lima in 1952, when delegates from all Latin American countries interested in potato improvement would be invited.

1078* HAWKES, J. G.

Informe sobre la Comisión a Inglaterra (Report on a Commission to England).

Minist. Agric. Gan., Bogotá, Colombia. 1950, Pp. 45 (mimeographed).

A report of the visits made to potato breeding and other research stations in Great Britain at the behest of the Ministry of Agriculture of Colombia.

HAWKES, J. G.

Organización y planeamiento para el mejoramiento de la papa (Organization and plans for the improvement of the potato).

Agric. Trop., Bogota. 1951, **7** (5), 7-11; (6), 11-16; (7), 11-18; (8), 13-20; (9), 11-19.

This series of articles is based on two lectures given to the Sociedad de Agricultores in Bogotá, Colombia. They were designed to show the progress made during the years 1948-1950 by the writer in the planning and organization of a potato research station in Colombia, South America.

After dealing with the importance of the potato in Colombia, the choosing of a suitable site for founding an experimental station is mentioned, followed by an account of the trips made to all potato growing areas to study the problems that needed to be solved.

The planning of a detailed scheme of research is next dealt with and the results obtained up to the end of 1950 are mentioned.

Breeding work included the production of blight resistant hybrids, and selections for resistance to frost, earliness and good cooking quality. Preliminary studies were also carried out on the breeding of varieties resistant to heat, drought and low altitudes. Yield trials were held in various parts of the country, whilst agronomic studies included experimentation on the best sowing times, optimum distances between plants and rows combined with seed size, uniformity trials and sprout retardation with chemical inhibitors.

Fungicide trials for the control of blight included the use of six different commercial fungicides used at different spraying intervals. Several of these were shown to be as efficacious as Bordeaux Mixture in controlling infection.

A detailed account follows of the phytopathologist's work on blight inoculation and culturing, and studies on the physiologic races of blight in Colombia. A list is given of the species and breeding lines so far shown to be immune to the Colombian races of blight studied.

Inoculation tests on the "Veinal Yellows" virus (an indigenous disease in Colombia and Ecuador) have not indicated with certainty the method of transmission under natural conditions. Studies have been carried out on a field scale to estimate the decrease in yield obtained from infected plants when compared with normal healthy ones.

Fertilizer studies on the "páramo" type of soil where potatoes are generally grown in Colombia showed very strikingly the absolute need for phosphorus and the unimportance of potash in soils of this type. Mention is also made of the studies that are being carried out on the use of minor elements in improving potato yields in Colombia.

Entomological investigations centred on the control of a tuber-boring grub (*Trypopermnon* sp.) by the new chemical substances Chlordane and D.D. Considerable success was obtained from both these products.

Mention is also made of the seed certification campaign in Colombia which is now coming into action in the four Departments where the potato is most widely grown.

HOWARD, H. W.

Crops and Plant Breeding.

J. R. Agric. Soc. 1950, **11**, 129-39.

The section titles in this annual review article are :—Importance of Grassland, Grassland Ecology, Grassland Management, Varieties of Herbage Plants, Seeds Mixtures, Cereals—New Varieties and Variety Testing, Sugar Beet and Chemical Weed Control.

1069* HOWARD H. W.

The So-called Chromosome Races of *Cardamine pratensis* and *Nasturtium officinale*.

Nature. 1951, **168**, 477-8.

A number of additions and corrections to an account by Dr. G. Haskell on *Plant Chromosome Races and their Ecology in Great Britain* are suggested. In particular it is pointed out that the three different *Nasturtium officinale* agg. types with chromosome numbers of 32, 48, and 64 are not "chromosome races" but two distinct species and their hybrid.

1064* RICHENS, R. H.

The Essentials of the New Soviet Genetics.

Agric. Progr. 1950, **25**, 25-35.

A general review is presented of the genetical theories elaborated by Lysenko and his school. The topics considered include the application of dialectical materialism to biology, the influence of Marxist sociology, Lysenko's notion of selective assimilation, and recent Soviet theories on the absence of intraspecific competition. The evidence bearing on these and other Soviet genetical theories is examined.

1049* SACHS, L.

"Vegetative Hybridisation" in the Tomato.

Nature. 1951, **167**, 282-3.

No observable effect was obtained on the leaf shape or fruit colour of either stock or scion in 80 grafted plants. The flowers of these plants were bagged to prevent accidental cross pollination, and 1,172 plants were grown from the seed so obtained. None of these plants, progenies of the grafted plants, showed any changes in leaf shape or fruit colour which could be ascribed to the grafting, and the experiments therefore give no support to the claims of the Russian investigations.

OTHER PAPERS

BELL, G. D. H. **The Contribution of Plant Breeding to Crop Improvement.** *Agriculture: J. Minist. Agric.* 1951, **58**, 91-5.

BELL, G. D. H. **Plant Breeding at Cambridge.** *Agric. Merch.* 1951, **31**, 183-4, 209-10.

1066* BELL, G. D. H. **Some British Plant Breeding Problems.** *Agric. Progress*. 1950, **25**, 15-24.

COMMONWEALTH POTATO COLLECTION. **Report for 1949-50.** 21st Annu. Rep. Exec. Coun. Commonw. Agric. Bur. 1951, pp. 28-31.

DODDS, K. S. **Polyhaploids of *Solanum demissum*.** *Nature*, 1950, **166**, 795.

1046* **Report from the Commonwealth Agricultural Bureau of Plant Breeding and Genetics.** *Brit. Agric. Bull.* 1951, **3**, 247-8.

SWAMINATHAN, M. S. **Wild Relatives in Potato Breeding.** *Farming*. 1950, **4**, 370-3.

PLANT PHYSIOLOGY

1065* HOWARD, H. W. & LYON, A. G.

Effect of Light on the Germination of Watercress Seeds.

Nature. 1951, **168**, 253-4.

Heredity. 1951, **5**, 303.

Seeds of *Nasturtium officinale* will germinate in both light and dark but seeds of *N. microphyllum* will only germinate in the light. Since seeds from the cross auto-tetraploid *N. officinale* female \times *N. microphyllum* will only germinate in the light, it appears that the effect of light must be on the embryo and not on the testa, and that inability to germinate in the dark is dominant to ability. Results for the occasional seeds produced by the triploid hybrid *N. microphyllum* \times *officinale* confirm these two conclusions. The results for two other types of seed, *N. microphyllum* female \times *N. officinale* and amphidiploid *N. microphyllum-officinale* selfed, agree in showing that inability to germinate in the dark is dominant to ability. Similar results for light-needing *v.* indifferent seeds have been obtained by Honing (1830) in *Nicotiana*.

SOILS AND MANURES

CHILDS, E. C. & COLLIS-GEORGE, N.

The Control of Soil Water.

Adv. in Agron. 1950, **2**, 233-72.

This paper is a survey of the developments which have taken place during the last fifteen years in the theory and practice of soil water control. The plan of the review is based on a logically developed skeleton of basic concepts upon which to build a body of observed facts.

An account of the soil moisture characteristic (curve of moisture content *vs.* suction) and of modern methods of obtaining it experimentally is followed by recently developed interpretations in terms of Gouy layer contraction (appropriate to clays, which shrink) and of pore size distribution (appropriate to unshrinkable soils); the older concept of soil moisture constants is related to the moisture characteristic. Methods for measuring soil moisture content *in situ*, employing buried cells of plaster or certain textile materials, are seen to be applications of the phenomenon of the moisture characteristic as exhibited by the soil and by the cell material.

Disturbance of soil water equilibrium leads to water movement, the laws of which lead to a definition of hydraulic permeability of soil to water. This definition is old, but the accurate measurement of permeability, particularly of unsaturated soil, and the satisfactory relating of permeability to the physical constitution of the soil, are of recent date. This discussion leads to a review of the work on the diffusion of water down a moisture content gradient or moisture profile.

The movement of water down the profile in arid conditions is relevant to irrigation; the theory is not yet developed to a useful stage, whilst field observations are not a modern development. Recent work has been devoted mainly to attempting to relate certain arbitrarily imposed soil moisture conditions, reproducible in the laboratory to the practically important but elusive concepts of field capacity and wilting point.

In leaching climates the groundwater may need to be controlled by artificial drainage systems. The flow of water in the soil to such systems constitutes a problem in potential theory, and the development of the mathematical approach, both by pure analysis and by various types of "guided guessing" is outlined. This leads to a discussion of recent methods of groundwater survey and of field drainage experiments; modern methods of measuring permeability in the field constitute drainage experiments of special type and are discussed in this context.

The review ends with a very brief mention of some engineering aspects of soil water control.

1072* CHILDS, E. C. & O'DONNELL, T.

The Water-Table, Equipotentials, and Streamlines in Drained Land. VI. The Rising Water-Table.

Soil Sci. 1951, **71**, 233-37.

This paper concludes the series of investigations of types of drainage problem by the use of the electric analogue. Earlier papers should be consulted for descriptions of the method. The sequence of non-steady states of a rising water-table, consequent upon an increase of rainfall rate, is solved, as in part V, as a sequence of momentarily steady states but with surface flux comprising the *difference* between the rainfall rate and the momentary rate of increase of stored groundwater. The solution is only possible by inverting the problem, the analogue of the final state being constructed first and earlier stages of the prototype being stimulated by later stages of the analogue. Owing to technical difficulties this problem represents, probably, the limit of usefulness to which the electric analogue method may be pressed.

1071* NICHOLSON, H. H., ALDERMAN, G. & FIRTH, D. H.

An Experiment in the Control of the Ground Water-Level in a Fen Peat Soil.

J. Agric. Sci. 1951, **41**, 149-62.

The methods of investigation of the effect of ground water-level on crop growth, together with the field installations in use, are discussed.

Direct field experiments are handicapped by the difficulties of achieving close control on a sufficiently large scale, due to considerable variations of surface level and depth of peat within individual fields and to rapid fluctuations in rainfall and evaporation. Many recorded experiments are associated with climatic conditions of substantial precipitation during the growing season.

Seasonal fluctuations of ground water-level in Fen peat soils in England, in natural and agricultural conditions, are described.

The local soil conditions are outlined and the implications of profile variations are discussed.

The effective control of ground water-level on a field scale requires deep and commodious ditches and frequent large underdrains to ensure the movement of water underground with sufficient freedom to give rapid compensatory adjustment for marked disturbances of ground water-level following the incidence of heavy rain or excessive evaporation.

A working installation for a field experiment in ordinary farming conditions is described and the measure of control attained is indicated.

1056* NICHOLSON, H. H.

Groundwater Control in Reclaimed Marshland.

World Crops. 1951, **3**, 251-4.

The reclamation of marshy land is discussed, mainly in the light of experience gained in the English Fenlands.

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HANLEY, F. **Economics of Factory Carbonate of Lime.** *Brit. Sug. Beet Rev.* 1951, **19**, 145-7.

1059* WILSON, F. B. **Notes on a System of Composting in East Africa.** *Mother Earth.* Spring, 1951.

STATISTICS

1076* CAMPBELL, G. K. G.

Field Trials with Sugar Beet.

C. R. Inst. Int. Rech. Better., 1951. Pp. 39.

An account is given of various systematic and randomised arrangements for field experimentation, and the advantages of the types are discussed. Arrangements and special techniques used for sugar beet trials in various European countries are described in appendices contributed by local experts.

MISCELLANEOUS

1030* BIFFEN, SIR. R. H.

Obituary by Sir Frank Engledow.

Obit. Not. Fell. Roy. Soc. 1950, **7**, 9-25.

An account of Biffen's career, his genetic discoveries and his plant breeding achievements.

1094* WILSON, F. B.

Kenya. A District Team at Work.

Corona. 1951, **3**, 295-300, 337-9.

YULE, G. U.

Obituary by Sir Frank Engledow.

Camb. Rev. 1951, **73** (1769), 8.

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- Your Dairy Farming Problems Solved**. Pp. xviii+249. Dairy Farmer (Books) Ltd., Ipswich, 1951. Price 10s. 6d.

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